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इलेक्ट्रॉनिक प्रकार पंखा नियामक —  
विशिष्टि

( पहला पुनरीक्षण )

Electronic Type Fan Regulators —  
Specification

( First Revision )

ICS 29.120.10

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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Electric Wiring Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1984. This revision has been undertaken to bring it in line with latest international practices. This standard deals with safety and performance requirements of capacitor based, step type electronics fan regulators for use with single-phase ac fans up to 250 V.

In this revision following modifications have been made:

- a) Introduction of axial pull force knob test, and
- b) Introduction of electrical endurance test, resistance to abnormal heat and to fire, and constructional requirements.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Indian Standard

## ELECTRONIC TYPE FAN REGULATORS — SPECIFICATION

( First Revision )

### 1 SCOPE

This standard deals with safety and performance requirements of step type electronic fan regulators for use with single-phase ac fans up to 250 V.

### 2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this draft standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
302 (Part 1) : 2008	Safety of household and similar electrical appliances: Part 1 General requirements
1401 : 2008	Protection of persons and equipment by enclosures — Probes for verification
1885 (Part 55) : 1981	Electrotechnical vocabulary: Part 55 Electric fans
4905 : 2015	Random sampling and randomization procedures ( <i>first revision</i> )
9000 (Part 2/ Sec 1 to 4) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 2 Cold test, Section 3 Cold test for non-heat dissipating items with gradual change of temperature
9000 (Part 3/ Sec 1 to 5) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test, Section 3 Dry heat test for non-heat dissipating items with gradual change of temperature
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 8 Vibration (sinusoidal) test

### *IS No.*

### *Title*

11000 (Part 2/ Sec 1) : 2018	Fire hazard testing: Part 2 Test methods, Section 1 Glow-wire apparatus and common test procedure ( <i>second revision</i> )
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### 3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 1885 (Part 55) shall apply.

**3.1 Electronic Type Fan Regulator** — Fan regulator which incorporates electronic devices and components, such as resistors and capacitors, intended to regulate the speed of the fan.

**3.2 Electric Fan** — A propeller-bladed fan, having two or more blades, driven by a.c. electric motor and provided with a suitable mounting arrangement.

### 4 RATED VOLTAGES

The preferred rated voltages for the regulator are 230 V and 240 V single-phase a.c.


Nevertheless, regulators made for other voltages shall be considered to, comply with the specification provided they do so in all other aspects.

### 5 RATED FREQUENCY

The rated frequency shall be the standard frequency of 50 Hz.

NOTE — nevertheless, regulator made for other frequencies shall be considered to comply with the specification, provided they do so in all other aspects.

### 6 DESIGN AND GENERAL CONSTRUCTION

**6.1** The regulators may be either of ventilated or totally enclosed type. The enclosures, if metallic shall be reliably and permanently connected to earthing terminal or termination within the regulator, which shall be indelibly marked with the symbol “”.

**6.2** The regulators shall match in rating with the fans for which they are intended.

**6.3** The regulators shall have an 'off' position, preferably next to lowest speed contact.

**6.4** The speed regulator shall be capable of withstanding the moisture resistance test specified in **9.5.7**.

**6.5** In the assembled fan regulator, live parts shall not be accessible to the standard test finger (*see* IS 1401).

**6.6** Precautions shall be taken in the manufacture of regulators to ensure a reasonable degree of silence (absence of humming noise) in operation of the fan at all speeds.

## 7 GENERAL AND SAFETY REQUIREMENTS

### 7.1 Insulation Resistance

When measured according to **9.5.4**, the insulation resistance shall be not less than 2 M $\Omega$ .

### 7.2 Leakage Current

The leakage current which may flow from live parts to accessible metal parts and metal foil on external insulating material connected together shall not exceed 300  $\mu$ A (peak) that is 210  $\mu$ A (rms).

### 7.3 Temperature Rise

The regulator when tested at any ambient temperature not exceeding 40°C, the temperature rise shall not exceed the following values:

- |                                   |      |
|-----------------------------------|------|
| a) Frame enclosing the regulator  | 45°C |
| b) Knob:                          |      |
| 1) Metal                          | 20°C |
| 2) Moulded materials and rubber   | 15°C |
| 3) Porcelain or vitreous material | 20°C |

### 7.4 Mechanical Strength

Fan regulators shall have adequate mechanical strength and be so constructed as to withstand such rough handling as may be expected in normal use.

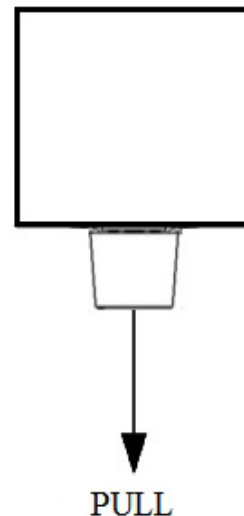
#### 7.4.1 Axial Pull Force of Knob

Knobs of electronic type fan regulators shall be securely fixed in a reliable manner so that they will not work loose in normal use, if loosening may result in a hazard. If knobs are used to indicate the position of regulators, it shall not be possible to fix them in wrong position, if this may result in hazard. Compliance is checked by inspection and by the following tests:

- Where it is possible to apply an axial pull in normal use, an axial pull shall be applied for 1 min to try to pull off the actuating member.
- The pull force should be minimum 15 N for 1 min.

During and after these tests, the regulator shall have no damage, nor shall an actuating member have moved so as to impair compliance with this standard.

NOTE — Sealing compound and the like, other than self-hardening resins are not considered to be adequate to prevent loosening.



### 7.5 Creepage Distances and Clearances

Creepage distances and clearances shall not be less than the values given in Table 1.

**Table 1 Creepage Distances and Clearances**  
( Clause 7.5 )

Sl No.	Parts	Creepage Distance (mm)
(1)	(2)	(3)
i)	Between live parts and accessible metal parts:	
	a) If protected against deposition of dirt	3.0
	b) If not protected against deposition of dirt	4.0
ii)	Between live parts of different polarity:	
	a) If protected against deposition of dirt	2.0
	b) If not protected against deposition of dirt	3.0
iii)	Between live parts and accessible metal parts:	
	a) If protected against deposition of dirt	2.5
	b) If not protected against deposition of dirt	3.0
iv)	Between live parts of different polarity;	
	a) If protected against deposition of dirt	2.0
	b) If not protected against deposition of dirt	2.5

**7.6** The regulators shall be provided with radio and television interference suppression devices so as to ensure that there is no noise/disturbance on radio/television when operated beyond a distance of 1 m from a regulator.

**7.7** The input RMS voltage from the regulator into the fan shall not be less than 98 percent of the supply voltage at the maximum speed position.

## 8 PERFORMANCE

**8.1** The regulator shall be capable of starting up from rest, the fan, with the regulator set at minimum speed setting, when 85 percent of the rated voltage is applied.

**8.2** The regulator shall be capable of reducing the speed of the fan by at least 50 percent of the full speed at the rated voltage.

**8.3** The regulator shall be of step type and shall have an 'off' position preferably next to the lowest speed contact and shall be provided with not less than four running positions.

## 9 MARKING

**9.1** Each regulator shall be clearly and indelibly marked with the following information:

- a) Manufacturers' name and trade-mark if any;
- b) Type, namely electronic type;
- c) Rated voltage (s) or rated voltage range;
- d) Maximum wattage;
- e) Frequency or frequency range; and
- f) Country name.

### 9.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

## 9.3 Classification Tests

### 9.3.1 Type Tests

The tests specified below shall constitute type tests and shall be carried out on three samples of the same type and rating; selected preferably at random from a regular production lot:

- a) Temperature-rise (9.5.1),
- b) Leakage current (9.5.2),
- c) High voltage (9.5.3),
- d) Insulation resistance (9.5.4),
- e) Earthing connection (9.5.5),
- f) Protection against electric shock (9.5.6),
- g) Voltage drop (7.7),
- h) Performance (8),
- j) Moisture resistance (9.5.7),
- k) Mechanical strength (9.5.8),

- m) Creepage distances and clearances (9.5.9),
- n) Electrical endurance test (9.5.10),
- p) Environmental tests (9.5.11),
- q) Resistance to abnormal heat and to fire (9.5.12),
- r) Resistance to rusting (9.5.13), and
- s) Checking of dimensions (9.5.14).

#### 9.3.1.1 Criteria for acceptance

All samples shall successfully pass all the type tests for proving conformity with the requirements of this Standard. If any of the samples fails in any of the type tests, the testing authority, at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all the tests or to the tests in which failure(s) had occurred.

No failure shall be permitted in the repeat test (s).

#### 9.3.2 Acceptance Tests

The following shall constitute the acceptance tests:

- a) Leakage current (9.5.2),
- b) High voltage (9.5.3),
- c) Insulation resistance (9.5.4),
- d) Earthing connection (9.5.5),
- e) Protection against electric shock (9.5.6),
- f) Moisture resistance (9.5.7),
- g) Performance (8), and
- h) Electrical endurance (9.5.10).

**9.3.2.1** A recommended sampling plan for acceptance tests is given in Annex A.

#### 9.3.3 Routine Tests

The following shall constitute the routine tests:

- a) Flash test (9.5.3.4),
- b) Insulation resistance (9.5.4.2), and
- c) Earthing connection (9.5.5).

## 9.4 General Conditions of Test

### 9.4.1 Test Voltage

When rated voltage is indicated on the nameplate, the test shall be conducted at the rated voltage. When a voltage range is specified, the tests are carried out at the highest value of the range.

### 9.4.2 Limits of Error of Electrical Instruments

The error in the indicated values of ammeter, voltmeters and wattmeters shall not exceed 0.5 percent of full scale value for instruments used for type tests. For routine and acceptance tests, instruments of accuracy class 2 may be used.

## 9.5 Schedule of Tests

### 9.5.1 Temperature Rise

#### 9.5.1.1 Measurement of cooling air temperature during tests

The cooling air temperature shall be measured by means of several thermometers placed at different points around the regulators at a distance of 1 to 2 meters and protected from all heat radiations and extraneous draughts. The thermometers used for this test shall be accurate to  $\pm 0.5$  °C. The value to be adopted for the temperature of the cooling air during a test shall be the mean of the readings of the thermometers taken at equal intervals of time during the last quarter of the duration of the test.

**9.5.1.1.1** Flush-mounted fan regulators are mounted in flush-mounted boxes. The box is placed, in a block of pinewood filled around the box with plaster, so that the front edge of the box does not protrude and is not more than 5 mm below the front surface of the pinewood block.

NOTE — the test assembly should be allowed to dry for at least 7 days when first made.

The size of the pinewood block, which may be fabricated from more than one piece, shall be such that there is at least 25 mm of wood surrounding the plaster, the plaster having a thickness between 10 mm and 15 mm around the maximum dimensions of the sides and rear of the box.

NOTE — the sides of the cavity in the pinewood block may have a cylindrical shape.

The cables connected to the fan regulator shall enter through the top of the box, the point(s) of entry being sealed to prevent the circulation of air. The length of each conductor within the box shall be  $80 \pm 10$  mm.

The other types of fan regulator shall be mounted according to the manufacturer's instructions or, in the absence of such instructions, in the position of normal use considered to give the most onerous conditions.

The test assembly shall be placed in a draught free environment for the test.

To ensure normal cooling of the terminal, the conductors connected to them shall have a length of at least 1 m.

**9.5.1.2** Load shall consist of fan of equivalent rated power for which regulator is suitable. The regulator shall be set at a position where maximum current is taken by this load.

#### 9.5.1.3 Measurement of temperature rise

The temperature rise measurements shall be carried out by the method by thermometers or thermocouples, immediately after the regulator has reached steady state conditions.

### 9.5.2 Leakage Current Test

The test shall be carried out according to **13.2** of IS 302 (Part 1).

### 9.5.3 High Voltage Test (Type and Acceptance Test)

**9.5.3.1** The source of supply for high voltage test shall be not less than 500 VA.

**9.5.3.2** The high voltage test shall be applied to regulators in normal working conditions except that these shall not be connected to the power supply.

**9.5.3.3** An a.c. test voltage of 1 500 volts at a frequency of approximately 50 Hz and sine wave form shall be applied between and terminal and the body and maintained for 1 min without showing any kind of breakdown or flashover. Electronic circuit of the regulator shall be short-circuited during this test.

#### 9.5.3.4 Flash test (routine test)

The test shall be carried out as specified in **9.5.3.3** except that the test voltage shall be applied instantaneously for 1s.

### 9.5.4 Insulation Resistance

#### 9.5.4.1 Type and acceptance test

When conducted as a type or acceptance test, this test shall follow the moisture resistance test (*see 9.5.7*). The insulation resistance of the regulator shall be measured with d.c. voltage of approximately 500 V, the measurement being made 1 min after the application of the voltage. Electronic circuit of the regulator shall be short-circuited during this test.

#### 9.5.4.2 Routine test

The insulation resistance test shall be carried out on regulator immediately after conducting the flash test.

### 9.5.5 Earthing Connection

This test is applicable to regulators with metal enclosure only. A current derived from an a.c. source having a no-load voltage not exceeding 12 V, and equal to 1.5 times the rated current of the regulator or 25 A, whichever is greater, is passed between the earthing terminal or earthing contact and each of the accessible metal parts in turn. The voltage drop between the earthing terminal of the regulator and the accessible metal part is measured and the resistance is calculated from the voltage drop and the current. The resistance value shall not exceed 0.1  $\Omega$ . Care is taken that the contact resistance between the tip of the measuring probe and the metal part under test does not influence the test results.

### 9.5.6 Protection Against Electric Shock

The test shall be conducted according to **8** of IS 302 (Part 1).



### 9.5.7 Moisture Resistance

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity of not less than 95 percent. The temperature of the air at all places where samples can be located is maintained at any convenient temperature in the range  $(40 \pm 5)^{\circ}\text{C}$  for a period of 48 h. Then it is subjected to test indicated in 9.5.4.1.

### 9.5.8 Mechanical Strength

The test shall be carried out by the impact test apparatus and in accordance with 21 of IS 302 (Part 1).

### 9.5.9 Creepage Distances and Clearances

The test shall be conducted according to the relevant provisions of 29 of IS 302 (Part 1).

### 9.5.10 Electrical Endurance Test

The regulator shall continue to function satisfactorily after being subjected to a test of 5 000 operations of the regulator when connected to a fan with locked rotor or an electrical load of an equivalent impedance supplied at the maximum rated voltage. One operation includes a full cycle of movement from the 'lowest (off)' position to the 'full speed' position and back to the original position. The test shall be made at the rate of 10 operation per minute (approximately) for step regulator.

### 9.5.11 Environmental Tests

**9.5.11.1** The regulator shall continue to function satisfactorily after being subjected to environmental tests of 9.5.11.2 to 9.5.11.4.

#### 9.5.11.2 Cold test

This test shall be carried out in accordance with IS 9000 (Part 2/Sec 3). The degree of severity shall be  $-10^{\circ}\text{C}$  for a duration of 4 h.

#### 9.5.11.3 Dry heat test

This test shall be carried out in accordance with IS 9000 (Part 3/Sec 3). The degree of severity shall be  $55^{\circ}\text{C}$  for a duration of 4 h.

#### 9.5.11.4 Vibration test

This test shall be carried out in accordance with IS 9000 (Part 8), with the details given below:

- Sweep frequency range 10 to 150 Hz;
- Displacement amplitude 0.15 mm; and
- Number of sweep cycles 5.

The direction of vibration is vertical; the regulator is fastened in its normal position of use.

### 9.5.12 Resistance to Abnormal Heat and to Fire

Parts of insulating material which might be exposed to thermal stresses due to electric effects, and the

deterioration of which might impair the safety of the accessory, shall not be unduly affected by abnormal heat and by fire.

Compliance is checked by means of the tests as per 9.5.12.1.

#### 9.5.12.1 Glow-wire test

The test is performed according to IS 11000 (Part 2/Sec 1) under the following conditions:

- For parts of insulating material necessary to retain current carrying parts and parts of the earthing circuit, in position, by the test made at a temperature of  $850^{\circ}\text{C}$ , and
- For parts of insulating material not necessary to retain current carrying parts and parts of the earthing circuit in position, even they are in contact with them, by the test made at temperature of  $650^{\circ}\text{C}$ .

If the test specified have to be made at more than one place on the same product, care shall be taken to ensure that any deterioration caused by previous test does not affect the result of test to be made.

Small parts, such as washer are not subjected to tests.

The test are not made on part of ceramic material.

#### NOTES:

**1** The glow wire test is applied to ensure that and electrically heated test wire under defined test conditions does not cause ignition of insulating parts or to ensure that a part of insulating material, which might be ignited by the heated test wire under defined condition, has a limited time to burn without spreading fire by flame or burning parts or droplets from the tested part following down on to the pinewood board covered with tissue paper. If possible, the specimen should be a complete product.

**2** If the test can not be made on complete product a suitable part may be cut from it for the purpose of test.

The test is made on one specimen. In case of doubt, the test shall be repeated on two further specimen.

The specimen shall be stored for 24 h at standard ambient atmospheric condition before the test.

The test is made applying the glow wire once.

The specimen shall position during the test in the most unfavourable position of its intended use (with the surface tested in vertical position). The tip of the glow wire shall be applied to the specified surface of the specimen taking into account the condition intended use under which a heated or a glowing element may come in to contact with the product.

During the application time of glow wire and during the period of 30 s from end of the application time, the specimen and surrounding parts, including the layer under the specimen, shall be observed.

The regulator is regarded as having passed the glow wire test if:

- a) there is no visible flame and sustained glowing; and
- b) flames and glowing at the specimen extinguish within 30 s after the removal of glow wire.

There shall be no ignition of the wrapping tissue or scorching of the board.

#### **9.5.13 Resistance to Rusting**

Ferrous parts, including covers and surface mounting boxes shall be adequately protected against rusting.

Compliance is checked by the following test.

All grease is removed from the parts to be tested, by immersion in carbon tetrachloride, trichloroethane or an equivalent degreasing agent for 10 min.

The parts are then immersed for 10 min in a 10 percent solution of ammonium chloride in water at a temperature of  $(27 \pm 5)^\circ\text{C}$ .

Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of  $(27 \pm 5)^\circ\text{C}$ .

After the parts have been dried for 10 min in a heating cabinet at a temperature of  $(100 \pm 5)^\circ\text{C}$ , their surfaces shall show no signs of rust.

#### **NOTES:**

**1** Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

**2** For small springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are subjected to the test if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.

**3** This clause does not apply for electronic components used in the product.

#### **9.5.14 Checking of Dimensions**

Fan regulator shall comply with the manufacturers drawing.

Compliance is checked by measurement.



## ANNEX A

( Clause 9.3.2.1 )

## SAMPLING OF ELECTRONIC TYPE FAN REGULATORS

## A-1 SCALE OF SAMPLING

## A-1.1 Lot

In a consignment, all the electronic type fan regulators of the same rating manufactured in the same factory under similar conditions of production, shall be grouped together to constitute a lot.

**A-1.2** The number of regulators to be selected from each lot, shall depend upon the size of the lot, depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 2.

**A-1.2.1** These regulators shall be selected from the lot at random. In order to ensure tile randomness of selection procedure given in IS 4905 may be followed.

## A-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

**A-2.1** The electronic type fan regulators, selected according to col 1 and 2 of Table 2, shall be subjected to leakage current, high voltage insulation resistance, earthing connection, protection against electric shock, performance and power losses tests. A regulator

failing to satisfy any of these requirements shall be termed as 'defective'. The lot shall be considered as conforming to these requirements if the number of defectives found in the sample is less than or equal to the corresponding acceptance number given in col 3 of Table 2; otherwise the lot shall be rejected.

**A-2.2** The lot which has been found as conforming to the above requirements, shall then be tested for moisture resistance. For this purpose, the number of regulators to be selected from the lot shall be in accordance with col 1 and 4 of Table 2. The lot shall be considered as conforming to these requirements if no defective is found in the sample.

**A-2.3** The lot which has been found as conforming to the above requirements shall then be subjected to electrical endurance test. For this purpose, three regulators shall be selected from the lot at random. The lot shall be considered as conforming to this requirement if no defective is found in the sample.

**A-2.4** The lot shall be considered as conforming to the requirements of acceptance tests if **A- 2.1**, **A-2.2** and **A-2.3** are satisfied.

Table 2 Sampling Size and Acceptance Criteria

( Clauses A-1.2, A-2.1 and A-2.2 )

Lot Size	For Leakage Current, High Voltage, Insulation Resistance, Earthing Connection, Protection against Electric Shock, Performance and Power Losses Tests		For Moisture Resistance Test
	Sample Size	Acceptance Number	Sample Size
Up to 50	8	0	2
51 to 100	13	0	2
101 to 300	20	1	3
301 to 500	32	2	3
501 and above	50	3	5





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